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STENNIS SPACE CENTER

Space Shuttle Main Engine Testing Fact Sheet

The Space Shuttle Main Engine (SSME) was developed to meet the stringent demands of the U.S. Space Shuttle program. The shuttle offers unique capabilities not found in previous expendable launch vehicles. Its payload bay can hold large, single payloads or small, multiple payloads. The shuttle is manned by astronauts and is returnable to Earth for reuse.

Before it can safely transport its crew and payload into orbit, the Space Shuttle's three main engines must pass a series of rigorous tests. Since June 1975, this testing has been accomplished at NASA's John C. Stennis Space Center (SSC) in South Mississippi. As NASA's Center of Excellence for large propulsion systems testing, SSC is responsible for all activities related to the development testing and flight certification testing for the Space Shuttle Main Engines.

The engines are mounted individually in one of three large test stands, which are linked by a seven and one-half-mile manmade canal system. They are "hot fired" for various durations under different operating conditions to determine their flight readiness. Types of SSME tests conducted at Stennis are development tests, flight certification tests, margin demonstration tests, life extension tests and flight acceptance tests.

Other significant features of the SSME test complex are its control centers, data acquisition facilities, a high-pressure gas facility, a high-pressure water facility, an electrical power generation plant, and engineering and administrative offices. In addition, SSC is surrounded by a unique 125,828-acre acoustical buffer zone, which is a national asset.

The Rocketdyne Division of Rockwell International Corp. in Canoga Park, Calif., developed the SSME under contract with NASA at the Marshall Space Flight Center in Huntsville, Ala. The engines first flew on the Space Shuttle Columbia in April 1981 and have since provided the United States with a versatile, economical space transportation system. Stennis Space Center has the responsibility for management of SSME test operations.

Space Shuttle Main Engines use liquid hydrogen and liquid oxygen as fuel to power the shuttle during

its eight and one-half minutes of flight prior to orbit. The three main engines together provide most of the total impulse needed for the shuttle to reach orbit. Two solid rocket boosters, which provide liftoff thrust, are dropped off two minutes into flight and are later recovered from the sea. The main engines are reusable with flight-to-flight maintenance and are interchangeable between orbiters in the shuttle fleet.

The high performance of the shuttle main engine is the result of major advancements in rocket engine technology. The engine is so sophisticated that 50 times every second the SSME electronic controller evaluates itself and the engine and then adjusts the engine valves to obtain peak performance during the shuttle's launch and ascent.

The engine operates at pressures and power densities more than three times higher than that of the Saturn V rocket which carried man to the moon. A primary advantage of the SSME is that heavier payloads can be carried into space without increasing the size of the launch vehicle.

The Space Shuttle is the most capable and efficient human transportation system to space available on Earth, and SSC will continue to support this program by testing the Space Shuttle Main Engine into the 21st century. Stennis will also continue to per- form development tests on new flight hardware for the main engine to improve per- formance, extend life and lower costs. This new hardware includes Pratt & Whitney's alternate turbopumps. These new turbopumps incorporate state-of-the-art technology in their design and are expected to increase the safety margin and reliability of the SSME and require less maintenance. The Rocketdyne Phase II+ powerhead and large throat main combustion chamber, which permit the Space Shuttle Main Engine to achieve its required nominal thrust while operating the fuel turbine at lower temper- atures and pressures, will continue being tested at Stennis Space Center.

One SSME weighs 7,000 pounds (3,175 kilograms) and stands 14 feet (4 meters) tall. The engines produce between 390,000 and 490,000 pounds (1,735 and 2,180 kilonewtons) of thrust each. The three engines together develop over 37 million horsepower-enough to equal the output of 23 Hoover Dams. One main engine generates enough thrust to maintain the flight of two and one-half 747 airliners.

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